IN THE DRAWINGS:

Please replace Figure 2b with the substitute Figure 2b filed herewith.

IN THE SPECIFICATION:

Please replace the corresponding paragraphs in the specification with the following:

[0018] A second embodiment of the invention is an apparatus for predicting failure of a system. This apparatus comprises: sensors for acquiring data from the system and a computer, with the computer having a processor and memory. Within the memory are ~~instruction~~ instructions for measuring the data from the sensors; instructions for creating a prediction of a failure of the system using a model and the data; and instructions for communicating the prediction. The apparatus also comprises communication means for communicating the prediction.

[0022] FIGS. 2(a)-(d) illustrate a preferred embodiment of the off-board engineering portion of ~~a-n~~ an embodiment of a method of the present invention;

[0030] FIG. 1 is a schematic illustrating an embodiment of an apparatus of the present invention employed on a dynamic system 22. System 22 ~~is~~ in this illustrative embodiment is an automobile with the embodiment described as a device in the automobile, but dynamic system 22 could be any dynamic system, such as a helicopter, airplane, automobile, rail car, tractor, or an appliance. On-board Prognostic Instrument Engineer (OPIE) 10, generally includes a central processing unit (CPU) 18; a computer control 20; a user alert interface 26; and sensors 24. The CPU 18 receives input in the form of criteria, equations, models, and reference data 14 derived from engineering analysis performed at step 12 and the OPIE 10 uses such input to make a failure prediction at step 16.

[0040] Now referring to FIG. 2(b), formulation of probabilistic approach at step 84 requires identifying and selecting an appropriate probabilistic technique. Two primary probabilistic approaches may be appropriate for prediction analysis 30 (FIG. 1): fast probability methods (FPM), or simulation techniques (ST). FPM include response surface FPM 88 and direct FPM 92 techniques. A response surface approximates the failure physics of the system with a single mathematical relationship. A direct method can have disjoint mathematical ~~relationship~~ relationships and is more simplistic. ST include response surface ST 90 and direct ST 94 as well (FPM and ST techniques are discussed further with reference to FIG. 2(c) below, and see Ang and W. Tang, Probability Concepts in Engineering Planning and Design, Vols. I and II, John Wiley & Sons, 1975.). Several factors must be considered

during selection of probabilistic strategy (step 46) including: CPU 18 computational capacity or limitations; whether it is possible to formulate a response surface equation; the mathematical form of the selected failure models (steps 60, 62) (FIG. 2(a)); the needed prediction accuracy; the characteristics of the monitored system; and the desired update speed or efficiency, among others. All factors are weighed in the balance by one of skill in the art, recognizing that engineering analysis 12 (FIG. 1) must determine which probabilistic technique is most appropriate for prediction analysis 30 (FIG. 1) for the particular type of system 22 (FIG. 1).

[0055] An example applicable to response surface FPM 88 or ST 90 is where the CDF is represented by the simple equation POF=(constant)*(demand). The demand portion of the response surface calculated at step 146 yields at step 148 a POF that is then compared to POF threshold 104. POF is then verified using the method for confidence verification 108 (FIG. 2(b)) with memory device 34 (FIG. 1). For these analysis methods, if POF as determined at steps 148, 152, 156 is compared and verified at step 160 and meets the exceedence criteria, then in step 162 the warning criteria are followed and a warning is included in output data 32.

[0061] Sensors 24 measure data on any number of conditions, such as temperature, speed, vibration, stress, noise, and the status and number of on/off cycles of various systems. Data acquired by sensors 24 are transmitted via communication device 23 (for example: hard wire, satellite, and cell phone systems) ~~23 to~~ to computer control 20. Computer control 20 sends operation and sensor data 25 to CPU 18. Operation and sensor data 25 includes data from sensors 24 in addition to other data collected by computer control 20, such as weather conditions. CPU 18 creates input 28 by combining operation and sensor data 25 with information from memory device 34 and information from previous output data 32 that was stored in memory device 34.